A Study to Map Career Guidance Needs amongst Biotechnology Students with Special Reference to the National Capital Region

SHORT SYNOPSIS

Submitted in partial fulfilment of the requirement of the degree of

DOCTOR OF PHILOSOPHY
by

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Sector-43, Aravali Hills, Faridabad

Year: 2024

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

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Date: 13/03/2024

DECLARATION BY THE SCHOLAR

I hereby declare that the short synopsis entitled **"A study to map career guidance needs amongst biotechnology students with special reference to the National Capital Region"** being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in the Department of Education and Humanities under the School of Education and Humanities of Manav Rachna University, Faridabad during the academic year 2023-2024.

It is the work that is expected to be carried out under the supervision of **Dr. Pooja Parmar**, Assistant Professor, Department of Education and Humanities, School of Education and Humanities, Manav Rachna University, Faridabad.

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CERTIFICATE BY SUPERVISOR(S)

This is to certify that, the short synopsis entitled **"A study to map career guidance needs amongst biotechnology students with special reference to the National Capital Region"** is an original piece of work done by research scholar Shreya Malik under the supervision of **Dr. Pooja Parmar** for the degree of Doctor of Philosophy in the Department of Education and Humanities under the School of Education and Humanities of Manav Rachna University, Faridabad during the academic year 2023-2024.

Further, it is certified that the short synopsis is within the plagiarism limit and copy of the same is attached as per the University norms.

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ABSTRACT

The Indian biotechnology sector comprises biopharmaceuticals, bioagriculture, bioservices, bioinformatics, and bioindustrial segments and has witnessed substantial growth with 760 core companies and over 5,300 startups. This study delves into career trajectories within the Indian biotechnology industry, emphasizing roles in research & development, upstream processing, downstream processing, production, quality assurance, quality control, business development, intellectual property rights management, regulatory affairs, and scientific writing. Beyond academic qualifications, employers emphasize "Employability Skills" - a combination of domain knowledge, scientific fundamentals, and sector-specific expertise.

Academic institutions play a pivotal role in nurturing skilled human resource for nation-building. Numerous universities offer undergraduate, postgraduate, and doctoral programs in Biotechnology. However, as the biotechnology industry evolves and manufacturing technologies advance ahead, a notable gap has seemed to emerge between the knowledge acquired by students and the skills expected by employers. Employers express dissatisfaction with students' employability skills and need for upskilling of the students, necessitating collaboration between academia and industry to align biotechnology curriculum with industry needs.

The study proposes to analyse skill gap in biotechnology education and prepare comprehensive career guidance resource for M.Sc. biotechnology students. It highlights the need for skill gap analysis, presenting career guidance on job roles, requisite skill sets, and industry recruitment processes. The proposed resource aims to empower students, enabling them to align their interests, skills, and training with industry demands. This dynamic database, tailored to biotechnology, serves as a valuable tool for job search, networking, research, and long-term career development, providing graduates with a competitive edge in the evolving biotechnology job market.

Key words: Biotechnology, Career guidance, Skill gaps, biotech industry, educational institutions

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1. Introduction

Biotechnology orchestrates nature's wisdom to compose a future harmonized with endless possibilities.

Biotechnology is an interdisciplinary domain that amalgamates principles from biology, chemistry, physics, and engineering. Its aim is to devise inventive solutions for contemporary societal challenges in crucial sectors like healthcare, agriculture, environment, and industrial processing. The Government of India has identified biotechnology sector as a priority sector in order to become a leading knowledge economy in the world. Therefore, it is expected that biotechnology sector will contribute significantly to India's aim of becoming $5 trillion economy by the year 2024 through innovation and manufacturing (Parameswaran, 2019; Malik, 2023).

Biotechnology involves creating products through the manipulation of biological systems, such as living organisms or their derivatives. This includes the engineering of recombinants derived from wild types to enhance the quality of human life. Originating from ancient practices that harnessed animals, plants, and microorganisms to generate economically valuable goods, modern biotechnology employs advanced genetic engineering at the molecular level. This enables the development of genetically modified organisms for the production of vaccines, drugs, diagnostic tools, and various other applications which increase production to feed the world's population and offer treatments for many diseases which are critical for disease-free survival. Therefore, it is important to promote the development of the biotechnology sector due to its profound impact on the society and mankind (Panda et al., 2023).

India stands out as one of the leading global hubs for biotechnology, ranking among the top 12 destinations worldwide. Moreover, it holds the prestigious position of being the third biggest biotechnology hub in the Asia-Pacific region. In year 2023, India's biotechnology industry has crossed an estimated $92 billion, growing 15% from the year 2022. The Indian bioeconomy has witnessed a manyfold increase in valuation in the past decade, with COVID-19 pandemic giving the Biotechnology industry a much-needed push. Amidst the gloom of the COVID-19 pandemic, a silver lining emerged for the Indian biotechnology sector, signaling a pivotal moment. The Indian government actively promoted domestic bioindustries to view the challenges posed by the pandemic as a chance to showcase their capabilities on the global

biopharmaceutical stage. This period became an opportunity for them to expand their presence and influence in the international market.

Due to the global demand for Indian biopharmaceuticals, there is a huge market opportunity for Indian biopharmaceutical companies. Meticulous planning and strategy needs to be put in place for collaborations, regulatory approval, market access and skilled manpower (Panda et al., 2023). The rapid advancements in the emerging field of biotechnology have hastened progress. These breakthroughs may pave the way for the creation of numerous educational centers dedicated to imparting under-graduate, post-graduate and doctoral studies across diverse domains within biotechnology (Ninawe, 2019).

Biotechnology has emerged as a career avenue for students over the past few decades. There are different biotechnology career options available for students today. Pursuing career in teaching and research remains the preferred option amongst biotechnology students. Out of these students, only a minute fraction of them manages to secure positions within academic or research institutions (Taylor S, 2023). As we look at a changing world, in addition to teaching and research, there are many other career options which are equally interesting, challenging and rewarding. There are plenty career opportunities available in industry, policymaking, scientific administration and management, technology licensing, intellectual property rights management, science communication & dissemination, technical writing, manufacturing, quality control, regulatory, business development, sales & marketing, bioentrepreneurship and many other fields.

Hence, it is crucial for students to broaden their horizons beyond academia and research and contemplate opportunities within other realms especially the biotechnology industry. Therefore, a concerted effort is required by the policymakers, universities and faculty members to motivate and guide students in this direction.

On one hand, students lack guidance and awareness to purse career options in the biotechnology industry and on the other hand, employers demand students to exhibit a well-honed set of employability skills, enabling them to seamlessly integrate and make immediate substantive contributions to the workplace upon recruitment. It has been reported that there is mismatch in the skill-sets acquired by the biotechnology students and expectation of employers from the students joining the biotechnology industry.

A primary impetus for students to undertake post-graduate programmes lies in the pursuit of in-depth subject knowledge and skills in different areas of biotechnology and allied areas. While the attainment of commendable academic credentials holds significant merit, students should be equipped with employability skills such as conducting experiments independently,

compiling and analysing experimental data, handling equipments, engaging in critical and rational thinking, adept multitasking, methodically addressing challenges, navigating professional relationships, collaborating within teams, demonstrating leadership, proficient time and resource management, orchestrating events, resolving conflicts, and communicating with effectiveness, etc. (Govil, S, 2020). The inability of the universities / institutes conducting initiatives which may aid in equipping their students as well as lack of awareness amongst students about the requisite skill-sets might lead to mismatch of expectations amongst the employers.

It is thus imperative to analyse and disseminate career guidance information regarding diverse job profiles in the biotechnology industry, delineate requisite skill-sets, and elucidate recruitment procedures. This research aims to equip students with the knowledge and tools necessary to strategically navigate and forge their career trajectories. The study also aims to helps students to identify areas for skill updation to match the requirements of the career opportunities in biotechnology industry today. Moreover, this study will serve as a compass for students aspiring to pursue employment opportunities in the biotechnology domain, aligning their current interests, proficiencies and training with the exigencies of prospective biotechnology companies.

2. Review of Literature

Need for skilled human resource in biotechnology industry

The biotechnology industry job market is a dynamic and rapidly expanding field that offers a diverse range of career opportunities for professionals with a background in biology, chemistry, engineering, or related disciplines. With advancements in science and technology, coupled with increasing demand for innovative solutions in healthcare, agriculture, and environmental sustainability, the biotechnology sector has become a pivotal driver of global economic growth. The biopharmaceutical industry is rapidly emerging as a significant source of job opportunities for biotechnology graduates. Biopharmaceutical industries belong to the high-tech sector; therefore, (Ghosh, 2023) states that manpower must have adequate managerial skills and expertise in modern biotechnology, including research and production. Specific skills, instruments, and equipment usage patterns have significantly contributed to developing and manufacturing biopharmaceutical products, services, and technologies worldwide. Even when biopharmaceutical industries look for biotechnology graduates at large, students are struggling to secure jobs in the biopharmaceutical industry. This can be attributed to various factors which have been discussed above. In its entirety, even when biopharmaceutical sector is the most promising area for jobs catering to biotechnology graduates, lack in exposure, skills, expertise and experience lead them to disappointment when it comes to securing jobs.

The National Biotechnology Development Strategy, Department of Biotechnology (DBT), Government of India (DBT, 2021) highlights the importance of skilled human resource for meeting the growing needs of Indian biotechnology sector. The report emphasizes key priorities of the Government of India under skill development including building a skilled workforce to fulfil the requirements of the biotechnology industry, enhancing employability, ensuring quality of the human resource is at par with the global best, creating human resource in strategic areas and updating biotechnology curriculum to keep pace with contemporary developments.

The Assessment of Skill Requirements of Indian Pharma Industry study (Department of Pharmaceuticals, 2022) identified and analysed the specific skill sets and expertise needed within the Indian pharmaceutical industry. The report outlined the industry's evolving needs in terms of workforce skills & capabilities of the Indian pharmaceutical workforce. The report specified that there is an urgent need for enhanced coordination between the Indian

pharmaceutical industry, academia and to improve the employability of the pharmaceutical students.

The Skill Assessment & Anticipation Study (Ministry of Skill Development & Entrepreneurship, 2021) assessed the skill requirements and challenges within the manufacturing sector in India. As per the findings of the study, it was reported that the current skill ecosystem falls significantly short in meeting the demand for skilled workers in technology-intensive sectors, such as the life sciences sector. The life-sciences sector firms felt that there was a gap between sector demand and curriculum of existing programs for supply of skilled candidates.

As per a study conducted by National Skill Development Corporation (NSDC), it was reported that there exists a significant skill gap in human resources in the Indian pharmaceutical industry (NSDC, 2012). The report recommends not only stronger academia – industry linkages to identify job role specific skill-sets but also create mechanisms to spread awareness of job roles in the industry along with incorporation of industry component in biotechnology curriculum accordingly. The biopharmaceutical sector is undergoing a transformation, transitioning its emphasis from recombinant therapeutics to more complex precision therapeutics and cell and gene therapies. The advancement of the biotechnology industry, driven by innovative research and development (R&D), hinges on the accessibility of a broad and highly skilled workforce. Stakeholders from research, academia, industry and governmental bodies identified several drivers as reported by (Uppal et. al., 2022) which are required for capability building including skilled human resources, public–private partnerships, advanced manufacturing platforms and favourable policies to be globally competitive. Focused training is essential, emphasizing problem-solving skills and a deep understanding of contemporary, state-of-the-art technologies adhering to global standards. Additionally, proficiency in quality processes and products is crucial. It is imperative that the curricula of both undergraduate and graduate programs in educational institutions align closely with current industry practices to ensure relevance and preparedness for the professional landscape.

Even when the biotechnology industry keeps reeling with the shortage in manpower and skilled professionals, it has been estimated that bioprocess and contract manufacturing services (Bhatkande, 2023) sectors of the biotechnology industry will suffer from potential delays in manufacturing and increased costs which may lead to significant impacts on the industry's supply chain. In such a scenario, the industry will need sufficient workforce in order to meet the demands of the market. Hence, job opportunities will multiply by manyfold for biotechnology graduates in the coming decade.

Employability skills in biotechnology

The study conducted by (Saunders & Zuvel, 2010) evaluated the perception of employability skills amongst students of biomolecular sciences and their employers wherein both students and employers ranked the importance of core and personal skills in pursuing careers in biology. The study implicated the criticality of personal career development planning, value of student self-assessment of their skills and knowledge of recruitment processes to students. Several studies (Furnell & Scott, 2015; Choudhary & Miah, 2016; Demaria, et al., 2018; McGunagle & Zizka, 2020) identify the perception of employers, in addition to the students, regarding the employability and employability skills towards seeking good opportunities in the industry.

Educators in higher education have long grappled with the ongoing challenge of equipping students for their professional journey post-graduation. Beyond acquiring theoretical foundations, students should possess the ability to apply knowledge in diverse contexts and showcase tangible life and employability skills sought by employers. While numerous degree programs offer opportunities for developing transferable skills through activities like presentations and team collaboration, students often struggle to introspectively assess their skill development and comprehend the intricate ties between theory, practical application, and their learning experiences. The integration of authentic self-assessments can bridge these gaps, fostering meaningful connections between theory and practice, and effectively preparing students for the dynamic demands of the workplace.

Various manifestations of skill mismatch include deviations from the required job level, either below or above, and disparities in job domains. Previous studies have predominantly explored the impact of skill mismatch at the industrial and organizational levels, offering limited attention to individuals' perceptions of their skill alignment and utilization. The results of the studies (Mello et al., 2017; Mello & Wattret, 2021; Mello et al., 2021) have outlined the importance of eliciting feedback from students on their perception of employability skills enabling them to self-reflect and self-assess their own skills. This process helps the students to make connections between their academically gained knowledge and industry requirements for addressing gaps in biology education.

There have been several studies to investigate the skill gap and employability skills with their impact on job prospects amongst IT students and management students as reported by (Kapil, 2014; Bhatnagar, 2020; Bist et al., 2020; Desai, 2021; Nirmala & Dsouza, 2022).

The study (Jothi et al., 2013) examined the lacuna existing between Indian university standards and industrial standards in biosciences industry. However, the study was concentrated in the state of Tamil Nadu with feedback elicited from bioscience students and companies based in

Tamil Nadu. Moreover, biotechnology industry is vast – the type of employers from whom feedback has been elicited is not specified in the study. However, no specific studies have been reported wherein feedback has been elicited from biotechnology students from the National Capital Region or Northern States of India, since demographic factors play a very important role in career progression.

Provision of career guidance to biotechnology students

The popularity of delivering career guidance information through online mode is on the rise among career guidance professionals, universities, and policymakers. Digital resources for career exploration and guidance offer the advantages of convenience and cost-effectiveness for students grappling with career decision-making, as well as for professionals who support the students in this process. Studies show the interventions through online career guidance have benefited the students (Misra & Chatterjee, 2014; Talib, et al., 2015; Teychenne, et al., 2019; Hossain, et al., 2022; Zammitti, et al, 2023).

An assessment of the literature reveals that earlier research has mostly concentrated on employability skills in various non-biotechnology industries. There has been little progress in categorising the numerous limitations and challenges that biotechnology students encounter when choosing a field of interest, and a student who chooses a career option without considering current employability considerations. The past studies have not covered a comprehensive and structured approach which the present study shall cover in mapping the perceptions of biotechnology students and the industry requirements while connecting it to the right and updated career guidance resources for students.

3. Description of Broad Area

3.1 Indian biotechnology sector

The Indian biotechnology sector is categorized into five principal segments: biopharmaceuticals, bioagriculture, bioservices, and bioinformatics, collectively shaping the bioeconomy. The Indian biotechnology industry consists of 760 core biotechnology companies, 100 biotechnology incubators and 5,300+ biotechnology startup ventures, which are estimated to reach the count of 10,000 by year 2025 (IBEF, 2023).

The trajectory of biotechnology industry expansion in India is chiefly propelled by the biopharmaceutical sector (Joshi & Govil, 2013). The biopharmaceutical sector encompasses recombinant therapeutics, biosimilars, molecular diagnostics, vaccines, phytopharmaceuticals, biomedical devices, genomic testing, and personalized medicine. The bioagriculture sector

consists of a spectrum of biotechnological interventions including crop biotechnology, animal biotechnology, aquaculture, and biofuels, among others. The bioindustrial sector, leveraging biotechnological applications in industrial processes, is revolutionizing manufacturing and waste management nationwide. Within the bioservices domain, offerings span clinical and contract research services. Lastly, bioinformatics permeates all facets of biotechnology, involving database creation and management, software tool development, in-silico drug design, and genome sequencing, among other applications (Govil, 2020). Of all segments of biotechnology industry, Indian biopharmaceutical sector is most profit-making sector (Panda, 2023). India has 665 USFDA-approved plants outside of the US, which is the highest in the world. India also has a 44% share of the total abbreviated new drug applications (ANDA) submitted globally and has more than 1400 manufacturing plants which comply with WHO requirements. In the year 2020, biopharmaceuticals contributed 62% to the Indian bioeconomy, followed by bio-agriculture (16%), bio-services (15%) and bio-industrial (7%) (Tiwari, 2022).

3.2 Careers in Indian biotechnology industry

The emergence of Biotechnology several decades ago presented students with a favourable alternative for career and employment prospects. In tandem with its biological, technical and engineering facets, Biotechnology has catalysed the emergence of various inter-disciplinary fields such as branches like biophysics, biochemistry, genomics, biomedical science, molecular biology, cell biology, biodiversity, bioinformatics, plant biotechnology, animal biotechnology, industrial biotechnology, etc., each offering distinctive employment opportunities (Biswas, 2023).

For students aspiring beyond traditional teaching or research roles, there are several promising career trajectories in specialized domains. Within the Biotechnology industry, key occupational roles can be broadly categorized into Research & Development (R&D), Quality Control (QC), Quality Assurance (QA), Production and Regulatory Compliance (Thomas et al., 2016; Lorenz, 2022). Additionally, opportunities abound in areas such as Marketing/Management, Intellectual Property Rights Management, Regulatory Affairs, Technical Writing, among others (Govil, 2020). Proficiency in these roles necessitates specialized domain knowledge, fundamental scientific qualifications, as well as sector- and product-specific training and expertise. This amalgamation of specific knowledge and skill-set, commonly referred to as 'Employability Skills', is paramount. Equipping students with information about the different roles, employability skill-set required is crucial, thereby transforming them from being merely valuable 'human resources' into indispensable 'human assets' for the Biotechnology industry.

3.3 Academic programmes in biotechnology

The higher education sector in India has a pivotal role to play in fostering a knowledge-based economy developing an innovation ecosystem, facilitating generation of technological breakthroughs and nurturing skilled human capital pool. At present, primary responsibility of nurturing skilled human resources primarily rests with the higher education system and its respective academic and research institutions across the country. There are numerous universities, institutions, and colleges offering undergraduate, postgraduate, and doctoral programmes in Biotechnology, catering to students 'career aspirations in this rapidly growing field churning out thousands of graduates/postgraduates across various Biotechnology streams in India (Biswas, 2023)

Several universities and affiliated colleges across the nation offer undergraduate (B.Sc/B.Tech), postgraduate (M.Sc/M.Tech) and doctoral (Ph.D) programs in biotechnology.

In the realm of higher education, three primary tiers of qualification exist: the bachelor/under-graduate level, the masters/post-graduate level and doctoral/post-doctoral level. As individuals progress along this educational continuum, the courses become progressively more demanding and specialized (Ninawe, 2019). Postgraduate programs are often pursued by students to delve deeper into their chosen subjects and to enhance their employment prospects. However, while the attainment of commendable academic qualifications holds significant merit, it may no longer suffice to guarantee employment. Employers expect students to exhibit a well-honed set of employability skills, enabling them to seamlessly integrate and make immediate substantive contributions to the workplace upon recruitment (Malik & Venkatraman, 2017).

The Department of Biotechnology, Government of India supports number of initiatives aimed at holistic human resource development. Keeping in mind requirement for trained human resource in various areas of biotechnology, DBT initiated Post-Graduate Teaching Programme way back in 1985 with 5 universities which has expanded to 65+ universities imparting M.Sc./M.Tech./M.V.Sc. degrees in different areas of biotechnology. These universities and institutes are provided financial support towards strengthening of laboratory facilities, equipment, consumables, studentships, dissertation grant, etc. under this programme (Ninawe, 2019). The selection of students who wish to pursue M.Sc. biotechnology programmes at the universities supported under Post-Graduate Teaching Programme is undertaken through all India entrance examination - Graduate Aptitude Test – Biotechnology (GAT-B) conducted annually across the country (NTA, 2023).

The M.Sc. Biotechnology program spans two years and consists of four semesters. It is crafted to impart students with a comprehensive comprehension of the field, encompassing the tools,

methodologies, and current trends within the realm of biotechnology. The M.Sc. Biotechnology programme may also have practical and research aspects where students learn managing research project independently, planning & designing experiments, data interpretation & analysis and writing thesis for the research project.

3.4 Employability skill gap in biotechnology students

Employability skills exhibit cross-industry applicability, spanning from entry-level to senior-level positions. From an employer's standpoint, 'employability' denotes a state of 'work readiness', signifying the possession of the necessary proficiencies, knowledge, attitudes, and business acumen that enable graduates to swiftly contribute effectively towards organizational objectives upon commencing employment (Saunders & Zuvel, 2010). Proficient human capital pool and cutting-edge infrastructure are imperative to promote innovation & manufacturing and meet the burgeoning demands of the Indian biotechnology sector. The success of the Indian biotechnology industry heavily relies on the technical acumen and competencies of its biotechnology workforce (Dhawan & Gokhale, 2007). Nevertheless, a discernible gap exists between the knowledge acquired by students and the skill set expected by the industry (Jothi et al., 2013; Ghosh, 2023).

Employers have expressed dissatisfaction with the present employment skills among graduates and expect universities and institutions to instil the desired employability skills in their students. Inculcating employability skills in students through internships, on-the-job training and practical training of students within the industry remains a formidable challenge, attributed to inadequate time, resources and funding. Employers advocate integration of employability skills into the course curriculum or through supplementary career guidance courses/programs to enhance career readiness of the students (Carter et al., 2023). Continuous interaction and engagement between industry and universities are required to discern industry needs and align academic programmes accordingly (Gahlout & Dwivedi, 2023).

However, in-depth analysis is required to ascertain in which areas of knowledge and training there is skill gap. Efforts to bridge skill gap and provide better career guidance can be made on the specific information pertaining to the requirements of the industry.

3.5 Career guidance for pursuing career in biotechnology industry

Students pursuing biotechnology often encounter crossroads, attributed to a lack of adequate awareness or guidance regarding employment prospects. Despite the abundant employment opportunities and diverse job roles accessible to biotechnology graduates, many students possess limited or inaccurate knowledge about these opportunities, requisite skill sets, and effective pursuit strategies. The transition to alternative career paths can be particularly

intimidating due to the scarcity of accurate information and misconceptions regarding the industry milieu or other potential career trajectories (Sadik & Brown, 2019). Additionally, faculty members may not always be equipped to mentor the students through this transition, given their own limited familiarity with the industry setup (Govil, 2020).

Moreover, it has been reported that there is mismatch in the skill-sets being taught in the academic programmes and expectation of employers. The need for skill gap analysis for M.Sc. Biotechnology students regarding career prospects in the Indian biotechnology landscape has become increasingly apparent. There is an urgent need to conduct stakeholder survey for analysis of the career guidance needs of students about various job roles within the biotechnology industry, requisite skill sets for career opprtunities and recruitment processes of the industry. This study will empower students to navigate and develop their career pathways in the biotechnology domain, aligning their interests, skills and training with the requirements of biotechnology companies. Such a resource would also facilitate the development of understanding the evolving trends within the industry will enable students to make informed decisions that align with their aptitude and goals in career decision-making.

Such a repository would help them in staying informed about industry trends, cultivating a resource for job applications, navigating the gaps in skillset, providing a resource for interviews and discussions, illustrating interdisciplinary knowledge, supporting long-term career development, facilitating collaboration etc. In conclusion, an information database as proposed via this project which is tailored to biotechnology can be a dynamic tool in job search. It will not only demonstrate students' expertise but also serve as a valuable resource for networking, research, and career advancement. By regularly updating and organizing relevant information, graduates can be well-prepared to navigate the competitive job market in biotechnology.

4. Objectives of Study

The proposed objectives of the study are given below:

1. To study the expectations of biotechnology companies with respect to skills of M.Sc. Biotechnology students joining biotechnology industry
2. To study the perception and awareness levels of M.Sc. biotechnology students of the National Capital Region with respect to requirement of skills and recruitment processes for seeking employment opportunities in biotechnology industry
3. To examine the initiatives undertaken by the universities/institutions of the National Capital Region offering M.Sc. biotechnology programmes to enhance employability opportunities of their students
4. To analyse the feedback from all stakeholders on career guidance needs for M.Sc. biotechnology students towards career initiation and seeking employment in biotechnology industry.

5. Methodology to be adopted for the Study

The methodology to be adopted for the study will include both qualitative and quantitative methods following a cross-sectional design to carry out research for the objectives of the study listed above.

5.1 Research Design

This study is structured as survey research in its design. The study will be designed as per the research design given by Jothi et al., 2013. The research design to be employed for the study will be both exploratory and descriptive in nature. For the exploratory research design, employability skills required by the biotechnology post-graduate students will be found out and understand policymaker's perspective will also be explored.

For the descriptive research, efforts will be made to analyse the responses of the stakeholders and the degree of relation between the variables being interpreted under the study.

An objective-wise methodology to be adopted for the study is given below.

5.1.1. Objective 3: To study the expectations of Biotechnology companies with respect to skills of M.Sc. Biotechnology students joining Biotechnology industry.

5.1.1.1.Research Instrument

The research instrument to be utilized during the research process will be a well-designed semi-structured questionnaire with 5-point Likert scale, wherein questionnaire

will be circulated through emails or information may be collected in-person, interview schedules and personal interviews.

5.1.1.2.Collection of Data

Primary data will be collected from biotechnology companies through online feedback form, personal interview and telephonic consultation will be used for gathering information. The data will be focused on their perception of employability skills and recruitment methods for getting employed in biotechnology companies.

The biotechnology companies for the survey will be identified and selected based on the following parameters:

- Biotechnology companies which have a R&D unit and operations based in India
- Biotechnology companies which are focussed on biopharmaceuticals products
- Biotechnology companies which have received grant from Biotechnology Industry Research Assistance Council (BIRAC), Government of India.

5.1.1.3.Sample Size and Sampling Technique

The sample size will be around 40 representatives of leading biotechnology companies. Random sampling will be followed for the study.

5.1.1.4.Data Presentation and Preparation

The information gathered via online forms undergoes an initial scrutiny to ensure consistency, including checks for range accuracy, typing errors, and adherence to permissible values. Subsequently, a refined dataset is generated for subsequent analysis. The compiled data sets are organized using MS Office suite applications, encompassing Word, Excel, and Power BI for comprehensive data management and analysis.

5.1.1.5.Statistical Tools and Data Analysis

Descriptive statistics will be employed to calculate mean and standard deviations. In addition, critical ratio analysis, correlation tests will be used for analysis of data. Analysis purportedly involves four stages: a discrimination test, a homogeneity test, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA) to establish the construct validity of the measure. The data will be interpreted and analyzed by using advanced software like SPSS as per the analysis carried out by Mainga, et. al., 2022.

5.1.2. Objective 2: To study the perception levels of M.Sc. Biotechnology students of the National Capital Region with respect to requirement of skills and recruitment processes for seeking employment opportunities in Biotechnology industry.

5.1.2.1.Research Instrument

The research instrument will be a well-designed semi-structured questionnaire with 5-point Likert scale, wherein questionnaire will be circulated through emails as well as personal interviews.

5.1.2.2.Collection of Data

Primary data will be collected from final year biotechnology students of leading universities / institutions in the National Capital Region through online feedback form, personal interview, telephonic discussion and questionnaire methods.

The universities/institutions for the survey will be identified and selected based on the following parameters (delimitation):

- Universities / institutions which are offering M.Sc. Biotechnology programmes in NCR region.
- Universities / institutions which are part of National Institutional Ranking Framework (NIRF) / All India Survey on Higher Education (AISHE) / Schemes of Department of Biotechnology (DBT), Government of India.

5.1.2.3.Sample Size and Sampling Technique

The sample size will be around 400 biotechnology students. Random sampling will be utilized for the study.

5.1.2.4.Data Presentation and Preparation

The information gathered via online forms undergoes an initial scrutiny to ensure consistency, including checks for range accuracy, typing errors, and adherence to permissible values. Subsequently, a refined dataset is generated for subsequent analysis. The compiled data sets are organized using MS Office suite applications, encompassing Word, Excel, and Power BI for comprehensive data management and analysis.

5.1.2.5.Statistical Tools and Data Analysis

Descriptive statistics will be employed to calculate mean and standard deviations. In addition, critical ratio analysis and correlation tests will be used for analysis of data. Analysis is also purported to be conducted in four stages: test of discrimination, test of homogeneity, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for determining the construct validity of the measure. The data will be interpreted and analyzed by using advanced software like SPSS as per the analysis carried out by Mainga, et. al., 2022.

5.1.3. Objective 3: To examine the initiatives undertaken by the universities/institutions of the National Capital Region offering M.Sc. Biotechnology programmes to enhance employability opportunities of their students

5.1.3.1. Collection of Data

The data will be collected from the secondary sources which would allow for accurate capture of data related to the number of students, enrolment details, initiatives undertaken by universities, career counselling cell, placement cell and other valuable data points useful for the study. In addition, consultations / interviews will be undertaken with the faculty of the universities / institutes to gain further insights for the study.

5.1.3.2. Statistical Tools and Data Analysis

The data will be interpreted and analyzed by using advanced software like SPSS as per the study carried out by Chandele-Parashar, R, et. al., 2022.

5.1.4. Objective 4: To analyse the feedback from all stakeholders on career guidance needs for M.Sc. Biotechnology students towards career initiation and seeking employment in Biotechnology industry.

5.1.4.1. Collection of Data

The data collected from the students and employers will be analysed and interpreted in detail. In addition, data will be collected from the secondary sources i.e. data related to the biotechnology sector, companies, policy insights, skill gap analysis, etc. A summary of the information proposed to be collected as part of the project includes, but is not limited to the following: publications / annual reports of central and state governments, funding agencies, policy think-tanks, industry reports / annual reports of biotechnology companies, journals, magazines, websites, etc.

5.1.4.2. Statistical Tools and Data Analysis

The data collected will be analysed to find the gaps between the perception of the students regarding the employability skills and requirements of the biotechnology industry. The accumulated data will be processed to through suitable statistical tools and graphical formats which are convenient for interpretation. The data will be analysed by using advanced software like SPSS as per the analysis carried out by Mainga, et. al., 2022.

6. Expected Outcome of Study

The harnessing of India's demographic advantages hinges on the reskilling and upskilling of the current workforce through lifelong learning programs. Additionally, it requires the effective preparation of new recruits with skill sets aligned with the demands of the twenty-first century. It is an immense challenge for the nation to undertake capacity building of human resourceor driving the Make in India initiative of the Government of India. Therefore, it is imperative that Government, policymakers, industry and academia take collective actions to develop the skilled workforce (Chenoy et al., 2019).

This research constitutes a pivotal component of a broader study endeavour aimed at discerning the pertinent employability proficiencies that will augment the holistic knowledge base and skill repertoire of M.Sc. biotechnology students. Subsequently, it will encapsulate the perspectives of employers regarding the employability acumen of graduates within the biotechnology domain. The investigation will serve to illuminate graduate competencies, affording students the opportunity to cognitively connect with, introspect upon, evaluate, and proactively manage their own proficiencies. It will tackle the pivotal concern of how a Masters' degree, within the Indian context, can serve as a catalyst for a nascent entrant into the job market, enabling them to secure employment within the Indian biotechnology sector.

The study will be highly significant to create career guidance resource for sharing comprehensive information about various career opportunities and job roles in biotechnology industry, skill-sets required and recruitment processes that will enable students to plan their career paths. Moreover, the findings of this study will help universities, institutions and policymakers in identifying employability skill gaps and taking necessary policy and administrative measures to address them effectively.

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A Study to Map Career Guidance Needs amongst Biotechnology Students with Special Reference to the National Capital Region

SHORT SYNOPSIS

by

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Under the supervision of
Dr. Pooja Parmar

Year: 2023

ABSTRACT

The Indian biotechnology sector comprises biopharmaceuticals, bioagriculture, bioservices, bioinformatics, and bioindustrial segments and has witnessed substantial growth with 760 core companies and over 5,300 startups. This study delves into career trajectories

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